OUTBREAK OF COVID-19 IN INDIA AND HIGH RISK OF CLUSTER CONTAINMENT: A CASE STUDY

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Abstract: This case study focusses on outbreak of COVID-19 in India and world. This will beneficial to analyze globally rising COVID-19 cases as well as in India in assessment with other 15 countries which are highly suffered with this pandemic. This analysis will be useful to predict the number of lockdown days required to combat COVID-19 in India.

Introduction:

The outbreak disease, Coronavirus (COVID-19) is holding its grip on the globe and the number of patients suffering as well number of deaths occurring due to this disease has reached height in the world. This disease is an infectious disease caused by a novel virus. The exact source or origin of this virus is still unclear. In the earlier days, it was believed that the virus may have developed in bats, and later pangolins. However, genomic comparisons suggest that the COVID-19 also known as SARS-Cov-2 virus is the result of a recombination between two different viruses. [01]

Most people infected with the COVID-19 virus will experience mild to moderate respiratory illness like flu with symptoms such as a cough, fever and in more severe cases, difficulty in breathing, however some people will recover without requiring special treatment. Older people, children and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness. The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes. Thus it's important that everyone should practice respiratory etiquette (for example, by coughing into a flexed elbow). The virus also spreads when a person touches a surface or object that has the virus on it, then touches their eyes, nose, or mouth. The best way to prevent and slow down transmission is be well informed about the COVID-19 virus, the disease, it causes, how it spreads and what kind of care should be taken to prevent it etc. At this time, there are no specific

vaccines or treatments for COVID-19. However, there are many ongoing clinical trials evaluating potential treatments. [01]

Objective:

1) To study and analyze globally rising COVID-19 cases of 15 countries, severely suffered with this pandemic.
2) To compare and correlate the rising cases of COVID-19 in India with other high risk countries. (rising of cases from 1000+ to 5000+, 7000+ and 8000+)
3) To study the Impact of lockdown and predict requisite of lockdown by further 28 days to combat COVID-19 in India.

Highlights of COVID-19:

December 31, 2019	Cluster of 27 pneumonia cases of unknown origin with 7 severe cases reported to China National Health Commission
January 7, 2020	Novel coronavirus isolated
January 11, 2020	First fatal case in China
January 13, 2020	First confirmed case in Nepal
January 19, 2020	First confirmed case in Republic of Korea
January 23, 2020	First confirmed case in Singapore **Shutdown of Wuhan City of China**
January 26, 2020	First confirmed case in Canada
January 28, 2020	First confirmed case in Germany
January 29, 2020	First confirmed cases in UAE, Finland and Italy
January 30, 2020	2nd Emergency Committee –WHO declares coronavirus outbreak a Public Health Emergency of International Concern PHEIC First confirmed cases in **India** and Philippines
February 11, 2020	WHO announced an official name to the virus responsible for COVID-19 as Severe acute respiratory syndrome Corona virus-2 (SARS-Cov-2)
Viruses are named by International committee on taxonomy of viruses (ICTV) and the diseases are officially named by WHO in international classification of diseases (ICD)	
March 11, 2020	WHO announced COVID-19 as pandemic disease.
March 24, 2020	Indian government declared lockdown of country for 21 days (25 march-14 April)

When the first case of COVID- 19 was reported in china on January 11, 2020, the disease made an outbreak in china and with a short span of time it started spreading in rest part of the globe. Almost 210 countries and territories of the world and two international conveyances are suffering from this pandemic today. The pandemic made a negative impact on the social and economic development of the world to a great extent within a short period. Today, One third of global population is on corona virus lockdown indicating the severity of this pandemic.

After report of first case of COVID-19 in India, the growth rate was initially very slow. There are many contributing factors, including the major steps taken by government of India. Unfortunately after a period of 3 months from reported first case, the number of cases has increased drastically and are being increased at a rapid rate.

It has been observed that, pattern of growth rate of COVID-19 cases (yellow and green color highlighted) is similar and close for the countries like Austria, Belgium, Netherland and Canada whereas other countries shows slightly fast growth by difference of 2-3 days. The data shows that India is following the similar pattern to above countries for rising of COVID-19 cases. The brief information about outbreak of COVID-19 in some of the countries is shown in the table 1 and 2. Graph 1 shows rise in COVID-19 cases in various countries of the world. The outbreak of COVID-19 in India is shown in table 3 and graph 2 and 3 shows comparison of number of cases in India with high risk and very high risk countries. The growth rate of COVID-19 cases in the world and in India are shown in graph 4 and Graph 5.

In this case study, we have focused on the rising pattern of cases of COVID-19 in India and a prediction is done for the rise in number of cases on the basis of comparison with other countries having similar pattern of growth. The number of cases reported in India from 30th January to 12th March are shown in table 3.

Table 1. Comparison/ analysis of rising of COVID-19 cases from cases 1000+ to 5000+ (yellow), 7000+ (green), 8000+ (red)

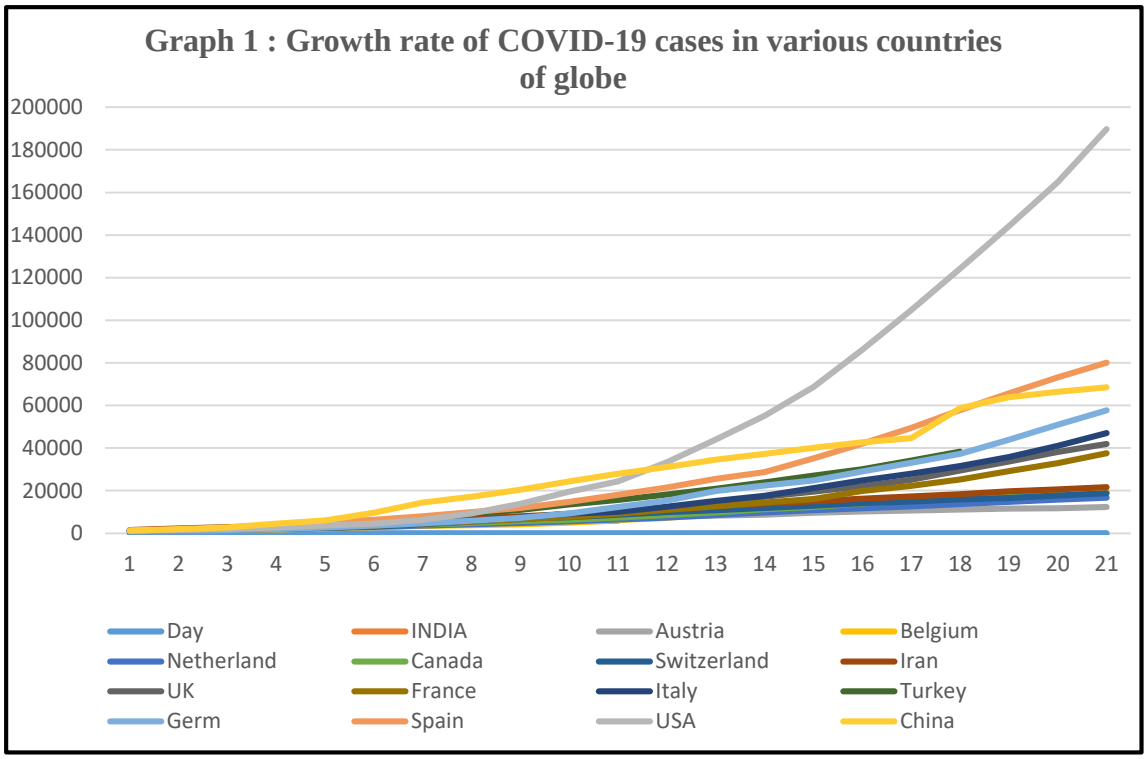
Rising of casesrom 1000+ Day	INDIA	Austria	Belgium	Netherland	Canada	Switzerland	Iran	UK	France	Italy	Turkey	Germ	Spain	USA	China
Date for Day 1	**29-03-20**	**16-03-20**	**16-03-20**	**15-03-20**	**20-03-20**	**13-03-20**	**2-03-20**	**14-03-20**	**8-03-20**	**29-03-20**	**22-03-20**	**8-03-20**	**9-03-20**	**11-03-20**	**24-1-20**
1	1024	1018	1058	1135	1087	1139	1501	1140	1209	1128	1236	1040	1231	1301	1282
2	1251	1332	1243	1413	1328	1375	2336	1391	1412	1701	1529	1224	1695	1630	1975
3	1397	1646	1486	1705	1470	2217	2922	1543	1784	2036	1872	1565	2277	2183	2744
4	1998	2179	1795	2051	2091	2353	3513	1950	2281	2502	2433	1966	3146	2770	4515
5	2543	2647	2257	2460	2792	2742	4747	2626	2876	3089	3629	2745	5232	3613	5974
6	3059	2992	2815	2994	3409	3115	5823	3269	3661	3859	5698	3675	6391	4596	7711
7	3588	3585	3401	3631	4043	4222	6566	5018	4499	4636	7402	4599	7988	6344	9692
8	4288	4474	3743	4204	4757	5615	7161	5683	5423	5883	9217	5813	9942	9293	11791
9	4778	5283	4269	4749	5655	6863	8042	6650	6633	7375	10927	7272	11826	13862	14380
10	5351	5588	4937	5560	6320	7474	9000	8077	7730	9172	13531	9367	14769	19494	17205
11	5916	6909	6235	6412	7448	8795	10075	9529	9134	10149	15679	12327	18077	24319	20440
12	6725	7697	7284	7431	8612	9877	11364	11658	10995	12462	18135	15320	21571	33319	24324
13	7600	8271	9134	8603	9731	10897	12729	14543	12612	1511	20921	19848	25496	44030	28018
14	8446	8788	10836	9762	11283	11811	13938	17089	14459	17660	23934	22364	28768	55196	31161
15	9205	9618	11899	10866	12375	12982	14991	19522	16018	21157	27069	24873	35136	68647	34546
16		10180	12775	11750	13912	14076	16169	22141	19856	24747	30127	29056	42058	86035	37198
17		10711	13964	12595	15512	14829	17361	25150	22304	27980	34109	32991	49515	104778	40171
18		11129	15348	13614	16667	15922	18407	29474	25233	31506	38266	37323	57786	124230	42638
19		11524	16770	14697	17897	16605	19644	33718	29155	35713	42282	43938	65719	144143	44653
20		11781	18431	15723	19438	17768	20610	38168	32964	41035	47029	50871	73235	164875	58761
21		12297	19691	16627	20765	18827	21638	41903	37575	47021	52167	57695	80110	189789	63851

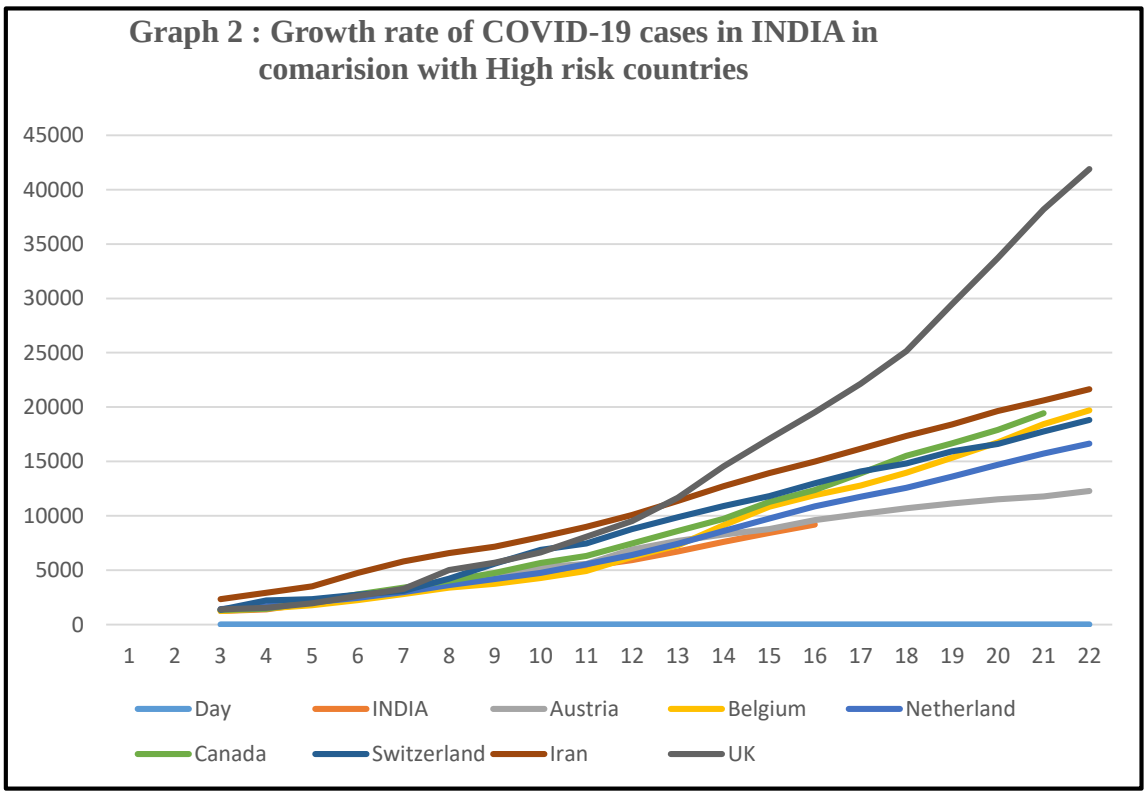
Table 2: Global COVID-19 Outbreak

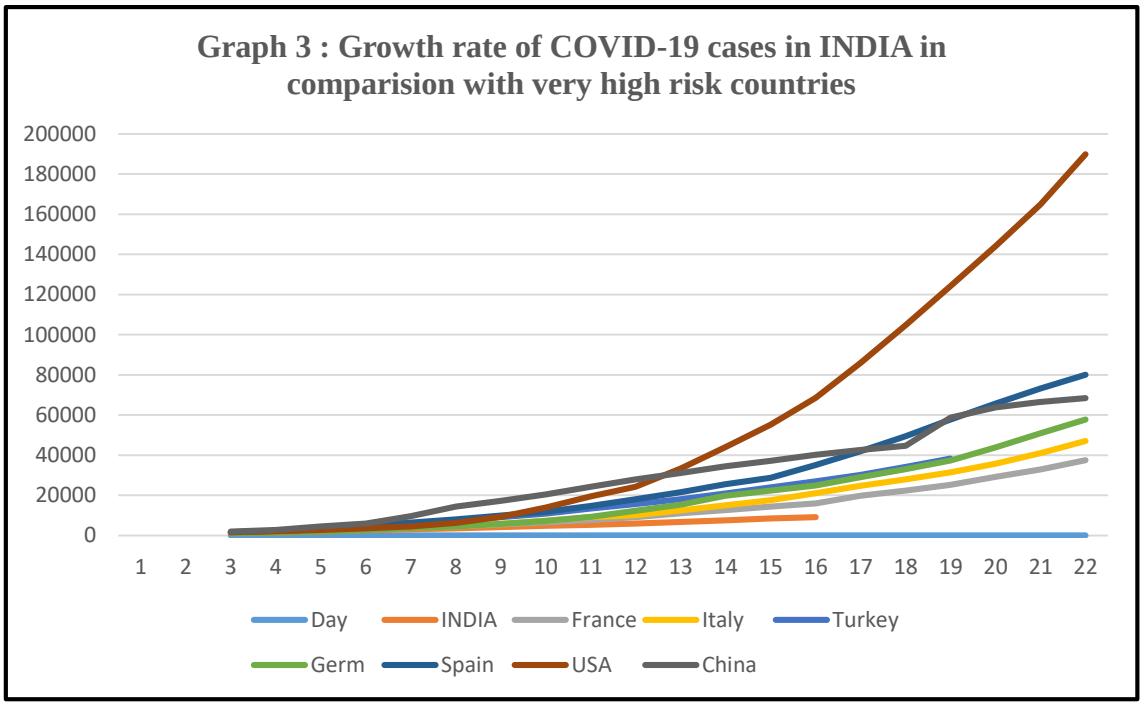
Date	**24/01/20**	**03/03/20**	**06/03/20**	**18/03/20**	**21/03/20**	**24/03/20**
No. of cases	1,317	90,869	102,050	218,744	304,979	422,574
Approx days require to rise 1 lakh cases	**41 Days**			**On average, 3 Days**		
Date	**26/03/20**	**28/03/20**	**29/03/20**	**31/03/20**	**01/04/20**	**02/04/20**
No. of cases	531,865	663,127	723,390	858,361	935,232	1015,096
Approx days require to rise 1 lakh cases	2 Days		**On average, 1.5 Days**			
Date	03/04/20	04/04/20	05/04/20	06/04/20	07/04/20	08/04/20
No. of cases	1116,662	1201,473	1272,901	1346,036	1430,981	1518,126
Approx days require to rise 1 lakh cases	**On average close to 1 Day**					
Date	09/04/20	10/04/20	11/04/2020	12/04/2020		
No. of cases	1,603,694	1698,881	1779,842	1852,365		

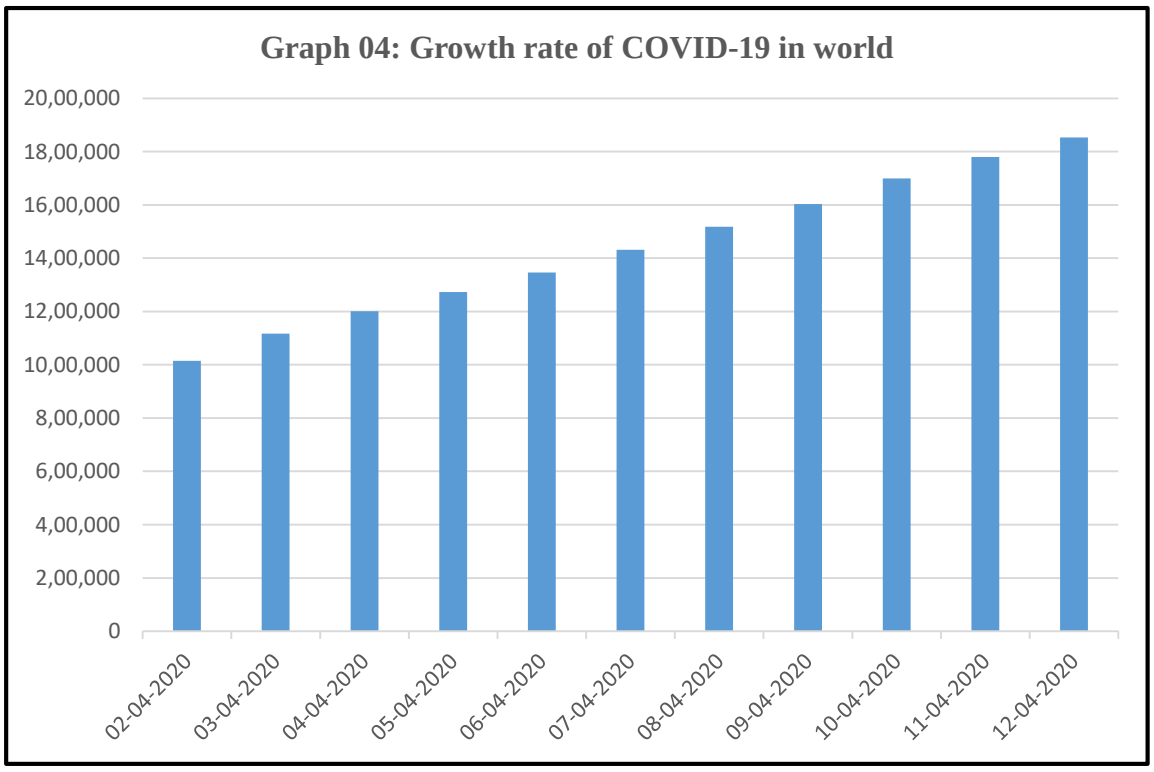
Table 3: Number of cases reported in INDIA from 30th January, 2020

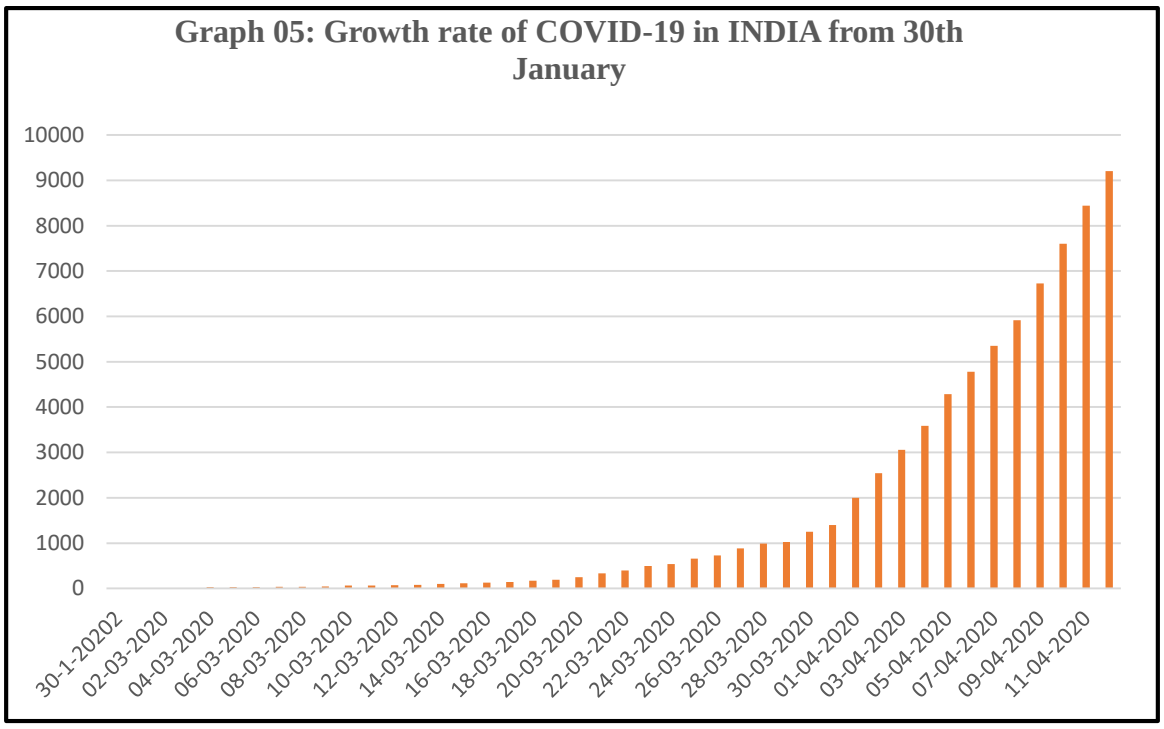
Date	30/01/20	03/02/20	02/03/20	03/03/20	04/03/20	05/03/20	06/03/20	07/03/20	08/03/20	09/03/20
No. of cases	1	3	6	7	29	30	31	34	40	47
Date	10/03/20	11/03/20	12/03/20	13/03/20	14/03/20	15/03/20	16/03/20	17/03/20	18/03/20	19/03/20
No. of cases	62	62	74	82	100	114	129	143	169	194
Date	20/03/20	21/03/20	22/03/20	23/03/20	24/03/20	25/03/20	26/03/20	27/03/20	28/03/20	29/03/20
No. of cases	249	332	396	499	536	657	727	887	987	1024
Date	30/03/20	31/03/20	01/04/20	02/04/20	03/04/20	04/04/20	05/04/20	06/04/20	07/04/20	08/04/20
No. of cases	1251	1397	1998	2543	3059	3588	4288	4778	5351	5916
Date	09/04/20	10/04/20	11/04/20	12/04/20						
No. of cases	6725	7600	8446	9205						











Lockdown, One of the major step taken to combat COVID-19 in India and many other countries: Lockdown is an emergency measure or condition in which people are temporarily prevented from entering or leaving a restricted area or building or city during a threat of danger. This scenario usually allows for essential supplies, grocery stores, pharmacies and banks to continue to serve the people. All non-essential activities remain shut for the entire period. Lockdowns can limit movements or activities in a community such that only organizations supplying basic needs and services can function normally.

WHO has already declared COVID-19 as pandemic and right now, no specific drug or vaccine is available to treat the disease, the only way to combat against it is PREVENTION. Lockdowns can limit movements or activities in a community while allowing most organizations to function normally, or limit movements or activities such that only organizations supplying basic needs and services can function normally. The objective of lockdown is to reverse epidemic growth, reducing case numbers to low levels by social distancing the entire population.

On 23 January 2020, the Chinese government locked down Hubei Province, including Wuhan, the city of 11 million where the outbreak started. After a lockdown of 76 days, the country could fight against covid-19 to major extent.

When studying the progression of the outbreak, two phases remain important - the first 100 cases, and every case after the first 100. India took almost 3 months to reach the first 100 positive cases of coronavirus, which then multiplied four times over the next ten days. Thus, looking at the increase in number of cases of COVID-19, Government of India has declared lockdown of 21 days on 25th march 2020 to 14th April.

Prediction for number of cases at the end of April based on data analysis: Even after a lockdown of 21 days, the growth rate of COVID-19 in India is in increasing order. Based on the data analysis of 15 countries, if India follows current growth rate (moderate), the number of cases may rise up to 30, 000-32,000 (Stage 2) by the end of April. If the growth rate remains high and follow the pattern of countries like Iran, UK and Turkey, number of cases may rise up to 78,000-80,000 (in between Stage2-stage 3) whereas if growth rate remains very high and follow countries like Spain, China, Germany, France and Italy, then the number of cases may rise approximately up to 105,000- 110,000 (Stage 3) at the end of April. If the growth rate in India follows like USA then the number of positive cases may increase beyond 500,000 (Stage 4). However the lockdown of country will definitely help to fight against this pandemic. The lockdown pattern that can be followed to combat against this disease is shown in figure 1. [3]

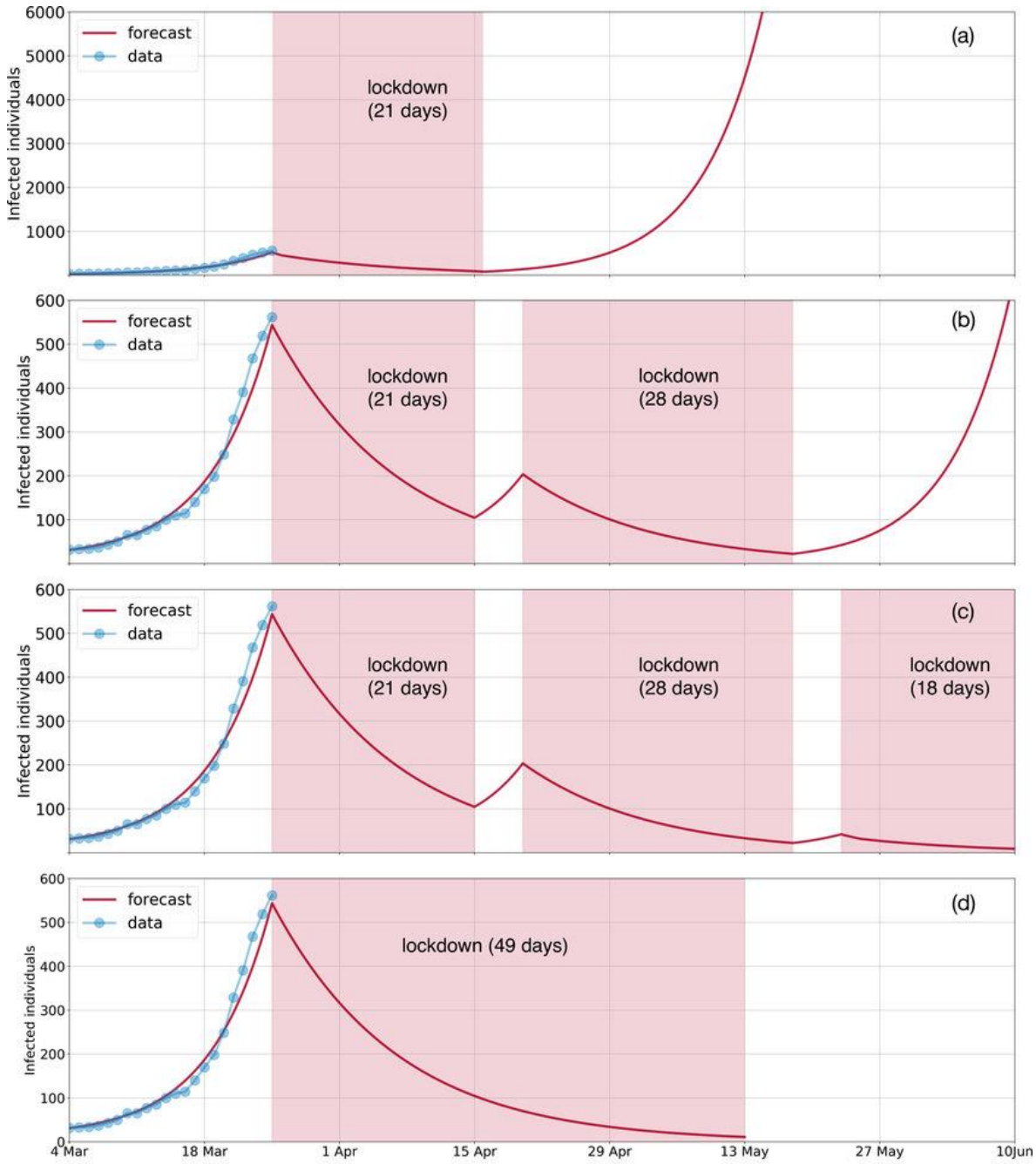


Figure 01: Forecast of the COVID-19 epidemic in India with migratory social distancing. Each of the four panels shows the variation in the number of invectives with lockdowns of various durations. The three-week lockdown starting 25 March does not prevent resurgence after its suspension as shown in panel (a). Neither does a further lockdown of 28 days spaced by a 5 day suspension, shown in panel (b). The protocols in panels (c) and (d), comprising of three lockdowns with 5 day relaxations and a single 49 day lockdown reduce cases to minimum numbers. [03]

Discussion and conclusion: Based on analytical data study of outbreak of COVID-19 in the globe, it has been observed that outbreak in India is following the same pattern of rising COVID-19 infected cases to the high risk countries like Belgium, Austria, Canada and Netherland. In future, the pattern may transform to very high risk countries like Italy, USA, Spain, France UK, Germany, Turkey, Iran, Switzerland and China, which all are in stage 3 and under cluster containment. India is currently at moderate risk and in a position to transform from stage two to stage three. (Cluster containment or social or communal transmission) due to following factors like (variation in prediction might be take place)

i) Highly denser population (second highest population in the world)

ii) Insufficient medical facilities to serve 130 crore population to combat COVID-19 in comparison with developed countries like USA and Italy.

iii) Screening of test samples per day are less as compared to most of the mentioned countries. (Till date total number of screened tests are, 189,111). [2]

From March 13th 2020, number of COVID-19 cases are increasing more than 500+ per day. The growth rate of COVID-19 cases is high and India ranked 27th on 5h April, 24th on 8th April and 21st on 9th April and might enter in top 10 countries with maximum number of covid-19 cases in upcoming week. In future, we need to take more care to avoid cluster containment which is possible only by extension of lockdown by further 28 days.

Till date India is doing well to COMBAT this pandemic and reported moderate number of COVID -19 cases in country. It is due to major steps and decisions by state and central government of India like 21 days country lockdown, the major contribution from Pharmaceutical industries, all peoples working in health sectors, police force, all social workers and at most the supporting public of India.

From this case study, it can be stated that, if the lockdown is increased for further 28 days, from 15th March to 13th May 2020, India can combat against this pandemic and become a country to win this war for nation. We all together can fight against COVID-19 by staying at home and supporting the government.

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